1 **METHOD OF OPERATION**
2.1 **WITH MEANS FOR CONTROLLING CASING OR FLOW GUIDING MEANS IN RESPONSE TO NATURAL FLUID CURRENT FORCE OR DIRECTION**
3.1 .Having specific features for water current
4.1 .Natural fluid current force responsive
4.2 ..Vertical runner axis
4.3 ..Axial flow runner
4.4 .Vertical runner axis
4.5 .Axial flow runner
5 **ENDLESS FLEXIBLE RUNNER (E.G., CHAIN, ETC.)**
6 **CYCLICALLY DIPPING, LIQUID RETAINING, ELEVATING AND DISCHARGING RECEPTACLE OR CONDUIT**
7 **FLOAT SUPPORTED OR BUOYANT RUNNER**
8 **DRIVEN, FLUID IMMERSED RUNNER WITH VANE IN UNCONFINED FLUID STREAM (E.G., TROLLING PLATE, ETC.)**
9 **INCLUDING DESTRUCTIBLE, FUSIBLE, OR DEFORMABLE NON-REUSABLE PART**
10 **WITH CONTROL MEANS RESPONSIVE TO MOTION DEVELOPED FLUID EDDY, ELECTRICAL, OR MAGNETIC EFFECT**
11 **WITH PUMP RECIRCULATION PASSAGE CONTROL RESPONSIVE TO WORKING FLUID CONDITION OR CHARACTERISTIC**
12 **WITH BIMETALLIC BLADE, VANE, OR ADJUSTMENT MEANS THEREFOR**
13 **WITH CONTROL MEANS RESPONSIVE TO NON-CYCLIC CONDITION SENSING, CENTRIFUGAL ACTUATION OR TORQUE**
14 .Casing, runner, or shaft position or extent of motion responsive
15 .With input signal of independent condition
16 .With testing means for speed control
17 .Plural diverse condition responsive (e.g., temperature and pressure, speed and level, etc.)
18 .Control of clutch or brake surface
19 .Including control of starting motor or runner blade starting position
20 .Control of working fluid and diverse apparatus part
21 ..Diverse part is runner portion or connection to shaft
22 ...Runner bypass from inlet controlled
23 .Responsive to working fluid discharge angle from blade or vane
24 .Responsive to liquid level or weight
25 .Centrifugally initiated valve controlling fluid flow in shaft or runner
26 .Responsive to moving member developed fluid force, current or pressure
27 ..Of relief valve in branched pump discharge line
28 ..Of valve bypassing runner stage
29 ..Motor and upstream working fluid flow control
30 .By shaft speed or torque responsive means
31 ..Helix or screw runner
32 ..Including reset or manual adjustment
33 ..Of adjustable runner, blade, shaft or bearing
34 ...Axially shifted runner, shaft or bearing
35 ..Of movable deflector intermediate jet discharge and runner
36 ..Of working fluid valve or vane
37 ...Including valve in interstage or re-entry passage
38 ...Plural passages with sequential or reverse fluid control
39 ....Inlet and relief or bypass valves
40 ....Fluid motor operated valve
41 ...With latch means for valve actuator
42 ...Actuated by runner or separate motor
43 ....Fluid servo-motor and speed responsive means actuated pilot valve

44 ...Multiple working fluid inlets to runner
45 ....On same radial plane with blade
46 ...Downstream of runner
47 .Temperature or fluid force responsive member
48 ..For adjustment of runner, shaft, vane or blade
49 ..Fluid force responsive member controls working fluid
50 ...For a plurality of runners
51 **WITH INDEPENDENTLY OPERATED TIMER OR PROGRAMMER ACTUATOR FOR WORKING FLUID CONTROL**
52.1 **WITH MEANS FOR RE-ENTRY OF WORKING FLUID TO BLADE SET (E.G., RE-ENTRY TYPE DEVICE, PASSAGE, ETC.)**
53.1 .Cross flow runner
53.2 ..Having vane or deflector within runner blade set
53.3 ..Having selectively adjustable vane or working fluid control means
54.1 .To opposite face of blade
55.1 .Turbine regenerative pump
55.2 ..Having specific means to deflect working fluid in regenerative passage
55.3 ...Means extends parallel to passage
55.4 ...Positioned at passage end (e.g., stripper seal, etc.)
55.5 ..Having plural, rigidly related blade sets
55.6 ...Acting serially but nonalternating (e.g., multistage, etc.)
55.7 ...In separate regenerative passages
56.1 .Pump priming means
56.2 ..Vertical runner shaft
56.3 ..Having plural and arcuately arranged vanes around runner
56.4 ..Re-entry through working fluid discharge passage for runner
56.5 ..Re-entry working fluid joins inlet working fluid upstream of runner
56.6 ..Walled pumping chamber positioned within liquid separation chamber
57.1 .Plural, independent, serially acting re-entry means
57.2 ..Having additional blade set in re-entry path
57.3 ..Re-entry from opposite sides of blade face
57.4 ..Re-entry into blade in radial plane of blade
58.1 .Having additional blade set in re-entry path
58.2 .Radial flow runner portion guides re-entry working fluid (e.g., hub, back plate, etc.)
58.3 ..Runner inlet shroud
58.4 .Re-entry working fluid joins inlet working fluid upstream of runner
58.5 ..Axial flow runner
58.6 .Open recirculation from and to blade set
58.7 .Axial flow runner
59.1 .Plural blade sets
60 **PLURAL RUNNERS SUPPORTED FOR RELATIVE MOTION OR ON SEPARATE SHAFTS**
61 .With means for selective runner operation or drive shaft connection
62 .Diverse type runners, blade systems or working fluid paths in runners
63 ..Including internally passaged runner with reaction type jet discharge nozzle
64 .Radial flow through concentric radially spaced blade rows
65 .Interdigitated, oppositely extending, coaxial, axially spaced blade rows
66 .Serially spaced in working fluid flow path
67 ..With initial fluid flow path to each runner
68 ..Coaxial runners
69 ...One runner support surrounds another
70 **RUNNER HAS PLANETARY MOTION OR ROTATES AROUND OBLIQUE OR CONSTANTLY MOVING AXIS**
71 **RUNNER HAS SPIRALLY ARRANGED BLADE OR FLUID PASSAGE**
72 .Extending along runner axis (i.e., axial flow)
73 ..Fluid conducting passage

74 ..With additional impingement means in fluid flow path
75 ..Motor runner
76 **FLUID FLOW BETWEEN PLURAL SINUOUS RUNNER SURFACES**
77 **AXIAL FLOW RUNNER WITH BLADES EXTENDING RADIALLY INWARD AND OUTWARD FROM COMMON ANNULUS**
78 .With means selecting only one blade row for working fluid flow
79 .Serial flow through inward and outward extending blade rows
80 **MOTOR RUNNER MOTIVATED BY REACTION TYPE JET DISCHARGE NOZZLE FROM INTERNAL WORKING FLUID CONDUIT**
81 .With additional rotary, fluid impinged blades
82 .With control of runner speed or direction
83 **RUNNER WITH ANNULAR BLADE ROWS OR FLUID CHANNELS SPACED ON COMMON RADIAL PLANE**
84 .Including peripheral blade row
85 .With means for reversing runner rotation
86 .Blades projecting axially from plural transverse runner faces
87 ..From opposed faces of common central disc
88 **PUMP HAVING ROTATING INLET END OR SCOOP IMMERSED IN LIQUID**
89 **CENTRIFUGAL BOWL PUMP**
90 **SMOOTH RUNNER SURFACE FOR WORKING FLUID FRICTIONAL CONTACT (E.G., UNBLADED RUNNER, ETC.)**
91 **ANNULAR RUNNER WITH INWARDLY PROJECTING BLADE**
92 **MOTOR RUNNER HAVING WORKING FLUID TRAPPING POCKET**
93 **AXIALLY OPPOSED WORKING FLUID PATHS TO OR FROM RUNNER (E.G., END BALANCE, ETC.)**
94 .With working fluid regulation or control means
95 ..For fluid motor
96 .With additional shaft connected end balancing fluid force reactor surface
97 .Pump impeller means
98 ..Impeller blades extending from opposite sides of common central support
99 ..Plural axially spaced impellers
100 ...Serially arranged in working fluid path
101 .Plural, separate, parallel, simultaneous flow paths
102 ..Towards each other and common exhaust
103 ..Plural, axially spaced blades in each path
104 **WITH SHAFT CONNECTED FLUID FORCE SUBJECTED THRUST BALANCING SURFACE**
105 .In separate chamber having non-system fluid inlet
106 .Fluid force on opposite face of blade or blade support member
107 .Motor shaft
108 **CASING AND SPACED HOUSING WITH SPACE VENTED TO WORKING FLUID**
109 **WITH SHAFT CONNECTED FLUID ABUTMENT MEMBER IN SEALING FLUID FILLED CHAMBER**
110 **WITH LUBRICATING, SEALING, PACKING OR BEARING MEANS HAVING INTERNAL WORKING FLUID CONNECTION (E.G., FLUID OR FLUID BIASED SEAL, ETC.)**
111 .For shaft sealing, packing, lubricating or bearing means
112 ..With inlet and outlet connections
113 ..Fluid biased, movable or resilient portion
114 **WITH CHANGING STATE CONFINED HEAT EXCHANGE MASS**
115 **WITH PASSAGE IN BLADE, VANE, SHAFT OR ROTARY DISTRIBUTOR COMMUNICATING WITH WORKING FLUID**
116 **WITH DIVERSELY ORIENTED INLET OR ADDITIONAL INLET FOR DIVERSE FLUID (E.G., HEATING, COOLING OR MIXED WORKING FLUID, ETC.)**
117 .Diverse fluids to motor
118 **WITH INSPECTION, SIGNALING, INDICATING OR MEASURING MEANS**
119 **WITH SOUND OR VIBRATORY WAVE ABSORBING OR PREVENTING MEANS OR ARRANGEMENT**
120 **CENTRIPETAL PUMP**
121.1 **WITH CUTTER OR COMMINUTOR FOR DEBRIS IN WORKING FLUID**
121.2 **WITH SEPARATING MEANS OR GUARD FOR SOLID MATTER IN WORKING FLUID (E.G., DEBRIS, ETC.)**
121.3 **COMBINED**

122.1 **INCLUDING SHAFT TRANSMISSION TRAIN, BRAKE, CLUTCH, OR ATTENDANT ACTUATED DRIVE MEANS**
123 .Brake or clutch
124 .Hand or foot operated crank, pedal or traction wheel
124.1 .Runner supported portion engages shaft transmission train (e.g., peripheral gear drive, etc.)
124.2 .Shaft transmission train having flexible means or coupling
125 **INCLUDING MEANS TO CAUSE CYCLICAL MOVEMENT OF A PART (E.G., BLADE, VALVE, ETC.)**
126 **INCLUDING CASING PART SELECTIVELY MOVABLE RELATIVE TO FIXED SUPPORT**
127 .Circularly around fixed runner axis
128 .Separate liner portion
129 **RUNNER OR BLADE SELECTIVELY ADJUSTABLE RELATIVE TO CASING**
130 .Relatively angularly adjustable plural blades or runners
131 .Axially adjusted
132 ..Shaft end supported on movable bearing
133 .Radially adjusted or centered shaft
134 **INCLUDING THERMAL EXPANSION JOINT**
135 .Resilient
136 .Radially sliding
137 ..Stator vane in shroud ring opening
138 ..And axial or circumferential expansion
139 .Circumferentially spaced nozzle or stator segments
140 **RESILIENT OR MOVABLY MOUNTED BLADE PORTION OR AXIALLY MOVABLE RUNNER OR SHAFT**
141 .Yieldingly or pivotedly mounted or flexible blade
142 **SHAFT BEARING COMBINED WITH OR RETAINED BY ARM OR VANE IN SURROUNDING WORKING FLUID SPACE**
143 **PLURAL RUNNERS HAVING DIFFERENT TYPE FLOW PATHS**
144 **WORKING FLUID BYPASS**
145 .Selectively adjustable vane or working fluid control for bypass
146 **INCLUDING WORKING FLUID FORCE RESPONSIVE VANE OR FLOW CONTROL**
147 .Upstream of runner
148 **SELECTIVELY ADJUSTABLE VANE OR WORKING FLUID CONTROL MEANS**
149.1 .Separate means upstream and downstream of blade set
149.2 ..Including axial flow blade set
149.3 ...Means to reverse flow through blade set
149.4 ...Plural, selectively adjustable, alternating vane assemblies and blade rows (A,B,A,B)
150 .Runner, shaft, or separate motor operated
151 .Upstream of runner
152.1 ..Motor runner with selective inlet paths for reversible rotation
152.2 ...Runner includes radial flow blade set
153.1 ...Separate runner blade set acted upon for reverse rotation
153.2 ....Axial flow blade set
154.1 ...Plural inlets simultaneously discharging working fluid onto single blade set
154.2 ....Axial flow blade set
154.3 ...Including axial flow blade set
155 ..Plural, independently adjustable
156 ..Deformable, resilient or resiliently biased
157 ..Single, axially movable cylinder or plate
158 ...Movable to position surrounding blade
159 ..Plural and arcuately or circularly arranged around runner axis
160 ...Individually pivoted vanes
161 ....And fixed vane
162 ....Plural, selectively adjustable vane sets
163 ....Pivoted parallel to runner axis
164 .....Vanes and blade in same radial plane
165 ...On same radial plane with blade
166 ....Circumferentially movable around shaft

167 ..Movable pipe or nozzle
167.1 ..Convertible series-parallel pump
168.1 **INCLUDING MEANS FOR HANDLING WORKING FLUID LEAKAGE**
168.2 .Leakage through seal between runner or shaft and static part
168.3 ..Screw type pumping seal
168.4 ..Means specific to axial flow runner
169.1 **INCLUDING MEANS FOR HANDLING PORTION SEPARATED FROM WORKING FLUID**
169.2 .Moisture or liquid separated from gaseous working fluid e.g., condensate removal, etc.)
169.3 ..Vane having specific moisture or liquid directing surface
169.4 ..Axial flow blade set and area for collecting moisture or liquid thrown radially outward
170.1 **BEARING, SEAL, OR LINER BETWEEN RUNNER PORTION AND STATIC PART**
171.1 .Dynamically created seal
172.1 .Means to seal radial flow pump runner inlet from outlet
173.1 .Between blade edge and static part
173.2 ..Selectively adjustable
173.3 ..Resilient, flexible, or resiliently biased
173.4 ..Erodable or permanently deformable
173.5 ..Labyrinth seal
173.6 .Between blade supported radial tip ring and static part
173.7 .Between axial flow runner and vane or vane diaphragm structure
174.1 .Selectively adjustable
174.2 .Resilient, flexible, or resiliently biased
174.3 ..Seal lies against axial face of runner hub
174.4 .Erodable or permanently deformable
174.5 .Labyrinth seal
175 **INCLUDING ADDITIONAL MEANS CAUSING OR CONTROLLING FLUID FLOW FOR HEAT EXCHANGING, LUBRICATING OR SEALING**
176 .Means subjected to or is working fluid
177 **INCLUDING HEAT INSULATION OR EXCHANGE MEANS (E.G., FINS, LAGGING, ETC.)**
178 .Working fluid on at least one side of heat exchange wall
179 ..Interstage heat exchanger
180 .Cooling fluid contacts shaft, seal or bearing
181 **MEANS, DISPOSITION OR ARRANGEMENT FOR CAUSING SUPERSONIC WORKING FLUID VELOCITY**
182.1 **WORKING FLUID PASSAGE OR DISTRIBUTING MEANS ASSOCIATED WITH RUNNER (E.G., CASING, ETC.)**
183 .Plural distributing means immediately upstream of runner
184 ..Inlet scrolls, or distributors within inlet scroll
185 ..Arcuately or circularly arranged around runner axis
186 ...On radial plane with runner blade
187 ....Plural, axially spaced sets of distributors
188 ....Radially inward of blade
189 ...Removably secured or mounted in casing
190 ....Axially arranged securing or mounting means
191 ...Vanes
192 ....Differentially twisted about radial axis
193 ....Plural, axially spaced vane sets
194 .....Diverse size or spacing in different spaced vane sets
195 ....Varied spacing between vanes in same set
196 .Passage or casing attached removable liner or wear member
197 ..Nonmetallic material
198.1 .Plural rigidly related blade sets
199.1 ..Including serial radial flow blade sets and intermediate stationary flow diverter(s)
199.2 ...Wherein the diverter includes divider vane(s) between the blade sets
199.3 ....Including spirally configurated vane(s)
199.4 ..Including an axial-flow blade set

199.5 ...Plural serial axial-flow blade sets with intermediate stationary flow diverter(s)
199.6 ...And radial-flow blade set in series therewith
200 .Specific casing or vane material
201 .Access opening through portion of casing or cover
202 .Nozzle discharging onto motor runner
203 .Casing having tangential inlet or outlet (i.e., centrifugal type)
204 ..Scroll-type casing
205 ...Inlet scroll
206 ..Axially directed inlet and tangential outlet
207 .Pump outlet or casing portion expands in downstream direction
208.1 .Vane or deflector
208.2 ..Plural and arcuately or circularly arranged in radial plane around runner axis
208.3 ...Plane intersects with runner blade
208.4 ....Plural, radially spaced vane sets
208.5 ....Nonradial flow runner
209.1 ...Plural, axially spaced vane sets acting successively or having specific spacing means
209.2 ...Having means for mounting diaphragm or plural vane holder to casing
209.3 ...Having specific vane mounting means
209.4 ....Vane fixed between radially separate surfaces
210.1 ...Fixed between radially separate surfaces
211.1 ..In radial plane with runner blade
211.2 ..Downstream of runner
212.1 .Scroll or helical type casing with specific exit nozzle
213.1 .Casing with mounting means
214.1 .Casing having multiple parts releasably clamped (e.g., casing seal, etc.)
215.1 .Casing having multiple parts welded, cemented, or fused
216.1 .With runner shaft of specific shape or material
217.1 .With runner having corrosion resistant or nonmetallic portion
218.1 .With runner having conical hub including small diameter facing upstream
219.1 .Casing with axial, conical flow runner
220 .Casing with axial flow runner
221 ..Having specific features for liquid flow
222 ..Pump with casing narrowing to runner
223 ..Having runner in orifice of radially extending partition or casing element
224 .Casing with nonradial flow runner (e.g., circumferential flow, etc.)
224.5 .Radial flow casing having vaneless annulus diffuser
225 .Exit chamber in radial plane axially offset from runner (e.g., sludge pump, etc.)
226 .Annular exit chamber outward of runner
227 .Runner having flow confining continuous passage
228 .Runner having full circular shroud for blades
229 **BEARING, SEAL, OR LINER BETWEEN SHAFT OR SHAFT SLEEVE AND STATIC PART**
230 .Seal
231 ..Resiliently biased
232 **MISCELLANEOUS**

## CROSS-REFERENCE ART COLLECTIONS

900 **ROTARY BLOOD PUMP**
901 **DRILLED WELL-TYPE PUMP**
902 **ROTARY PUMP TURBINE PUBLICATIONS**
903 **WELL BIT DRIVE TURBINE**
904 **TOOL DRIVE TURBINE (E.G., DENTAL DRILL, ETC.)**
905 **NATURAL FLUID CURRENT MOTOR**
906 .Having specific features for water current
907 .Vertical runner axis
908 .Axial flow runner
909 **AIR STACK OR SHAFT HAVING NATURAL FLUID CURRENT MOTOR**

910 **REVERSIBLE BETWEEN PUMP AND MOTOR USE**

911 **PUMP HAVING REVERSIBLE RUNNER ROTATION AND SEPARATE OUTLETS FOR OPPOSING DIRECTIONS OF ROTATION**

912 **INTERCHANGEABLE PARTS TO VARY PUMPING CAPACITY OR SIZE OF PUMP**

913 **INLET AND OUTLET WITH CONCENTRIC PORTIONS**

914 **DEVICE TO CONTROL BOUNDARY LAYER**

915 **PUMP OR PORTION THEREOF BY CASTING OR MOLDING**

916 **PERPETUAL MOTION DEVICES**

**FOREIGN ART COLLECTIONS**

FOR **CLASS-RELATED FOREIGN DOCUMENTS**